Memo

To: Craig Zeller, Remedial Project Manager,
U.S. Environmental Protection Agency

February 16, 2017

From: Amec Foster Wheeler Environment & Infrastructure, Inc.

CC: Gerald Pouncey, Morris, Manning & Martin, LLP
Heather Friedman, Morris, Manning & Martin, LLP

Ref: Koppers Charleston NPL Site, Technical Impracticability Waiver Proposal

Re: Supplemental Modeling Parameters – Supporting Model Documentation

In a memorandum dated October 26, 2016, Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) provided EPA with documentation summarizing the results of several iterations of the groundwater fate and transport model initially provided in the TI Waiver Demonstration Report (TIWDR) for the subject site. These iterations were made to address EPA requests (outlined in an earlier communication dated September 1, 2016) and included a combination of 17 different scenarios with multiple adjustments to model input parameters, an expansion of the ISS treatment zone, and a reduction of the initial source area dissolved benzene concentration from 2,000 ug/L to 500 ug/L. Based upon these modeling runs, ARI agreed to expand the ISS treatment zone, which increased the overall remediation cost by an estimated $1.1 million.

In an email received from EPA on January 25, 2017, a follow-up request was made to perform an additional model evaluation to supplement the model scenarios provided in October 2016. Consistent with the email request, dissolved benzene concentrations were further reduced from 500 ug/L to 318 ug/L. As discussed in further detail below, these concentrations are not indicative of the concentrations within the NAPL source area. The attached supporting model documentation is provided to depict the supplemental fate and transport model results with a re-adjusted benzene input parameter. A subset of parameters and permutations consistent with the prior submittal were used to re-evaluate model scenarios accordingly with the further reduction in benzene input concentration.

The attached model scenarios address EPA's concern regarding the original dissolved concentrations assumed for benzene in the Old Impoundment ISS Area (initially 5,000 ug/L, lowered to 2,000 ug/L during sensitivity analyses evaluation and alternative model calibration and then further reduced again at EPA's request, in the follow-on submittal to 1,000 and 500 ug/L). Responding to an additional request pursuant to a January 2017 email from EPA, an initial benzene concentration of 318 ug/L was assumed for the supplemental scenarios provided herein. While 318 ug/L represents the maximum detected benzene concentration dissolved in groundwater in the Old Impoundment Area over the previous five years, this concentration was observed in a well that is located downgradient of the NAPL source area. Previous site data

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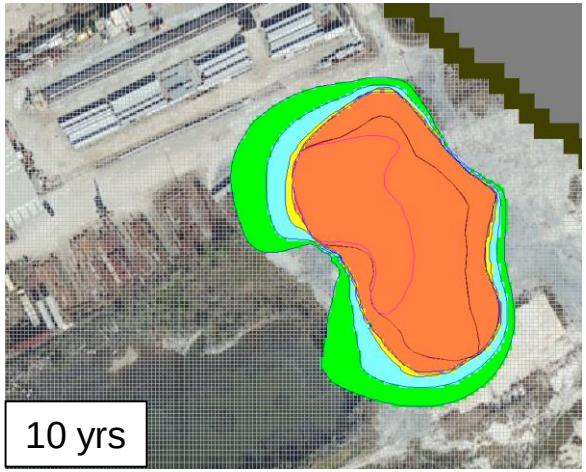
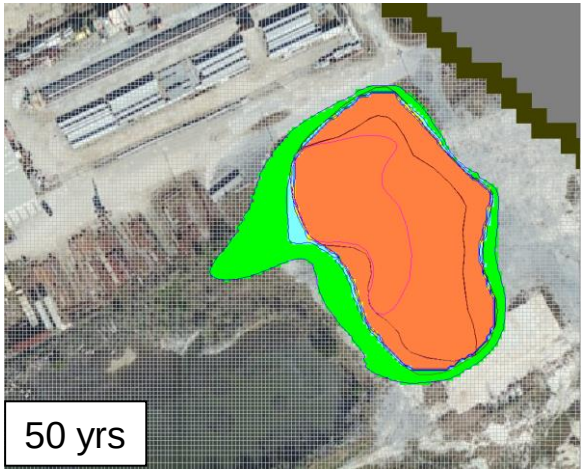
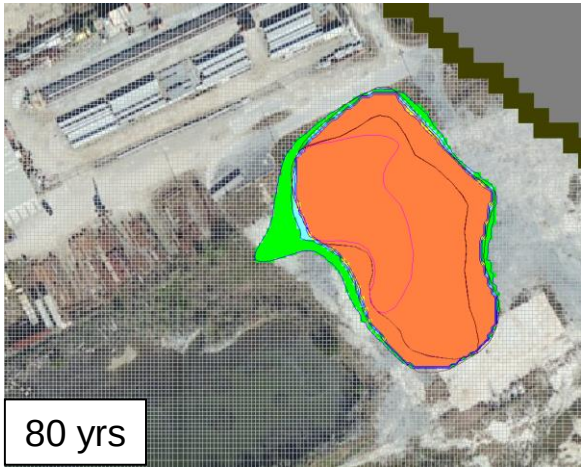
upgradient of the NAPL source area, and referenced literature values provided in the TIWDR and supplemental submittals, support the use of a significantly higher source area benzene concentration.

Nonetheless, Amec Foster Wheeler has prepared model runs assuming an initial benzene concentration of 318 ppb within the NAPL in the source area, and benzene plume depictions are provided based on these revised concentrations and varying other fate and transport model parameters consistent with representative scenarios provided in the October 2016 memo. Similar to earlier results, in every modeled scenario for the reduced initial source benzene concentrations, the fate and transport model indicates a benzene 'halo' continues to exist outside of the ISS treatment zone for an extended period of time (80 to 100 years).

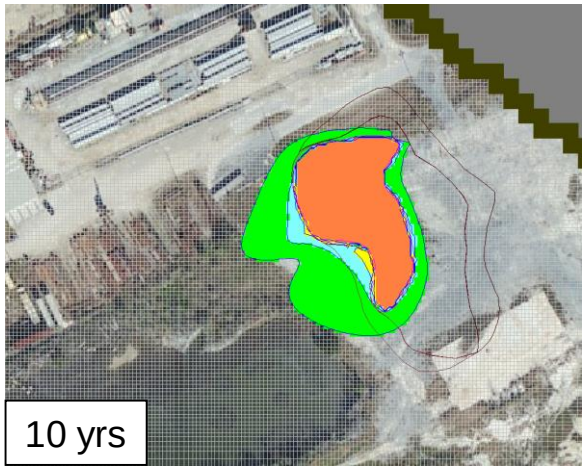
We believe that the information provided in the TIWDR and follow-up communication, including the fate and transport model representations provided herein, conclusively establishes the appropriateness of a Technical Impracticability Waiver for the former Koppers Charleston, SC NPL site.

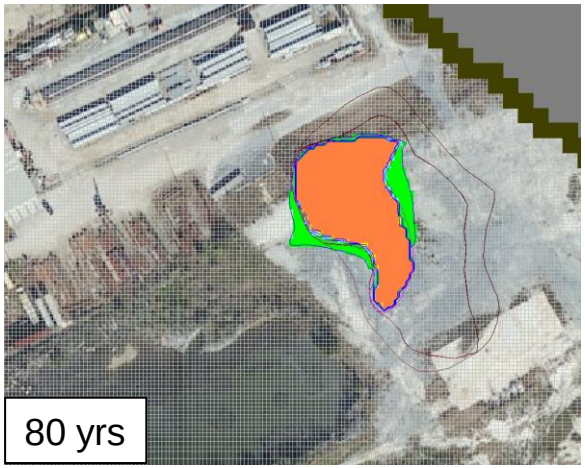






Layer 1, Shallow Zone



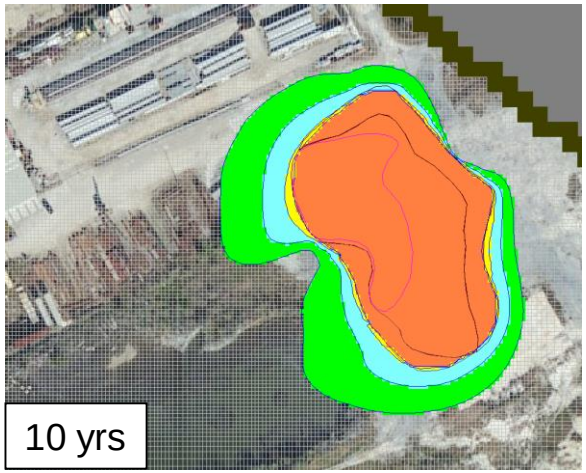


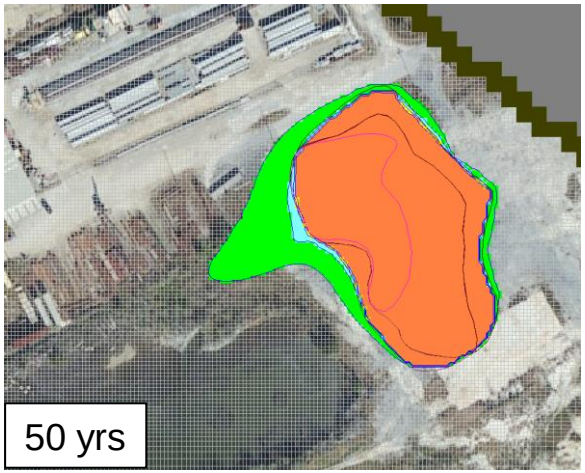
Layer 3, Intermediate Zone

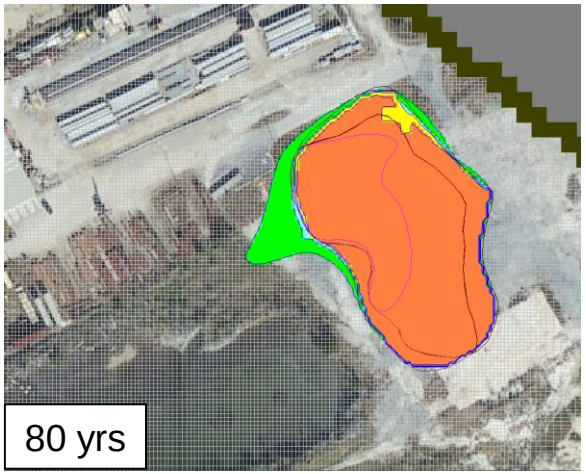
Dissolved Benzene Concentration, ug/L

- 5-20
- 20-50
- 50-100
- 318

Initial Concentration:	318 ug/L
Benzene half-life:	210 days
ISS Hydraulic conductivity:	10^{-7} cm/s
Mass transfer coefficient:	$5x10^{-12}$ 1/d
Longitudinal dispersivity:	10







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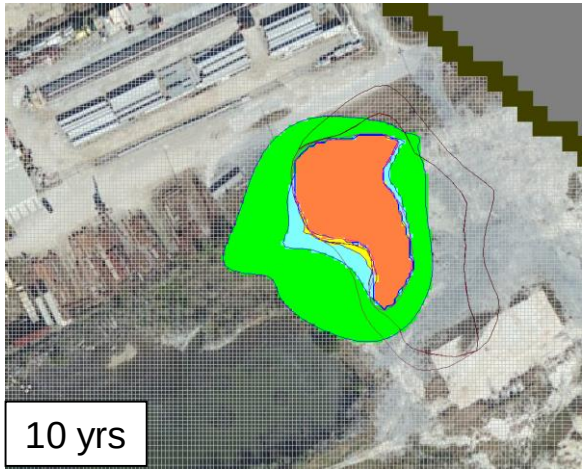

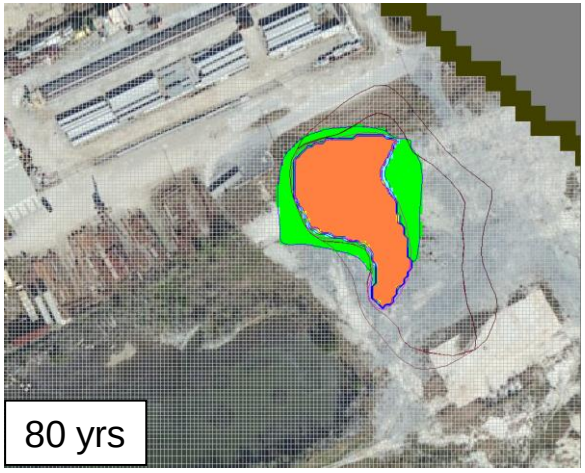

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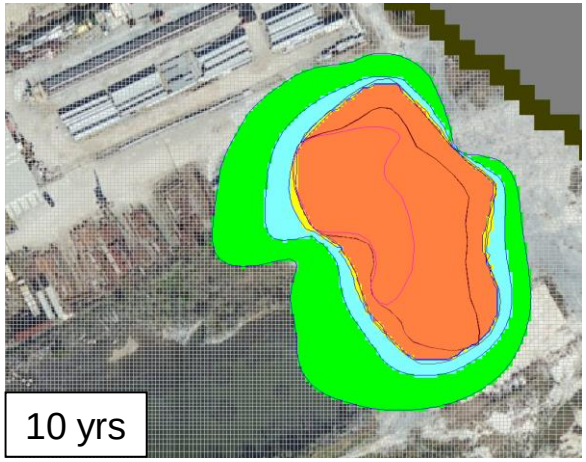

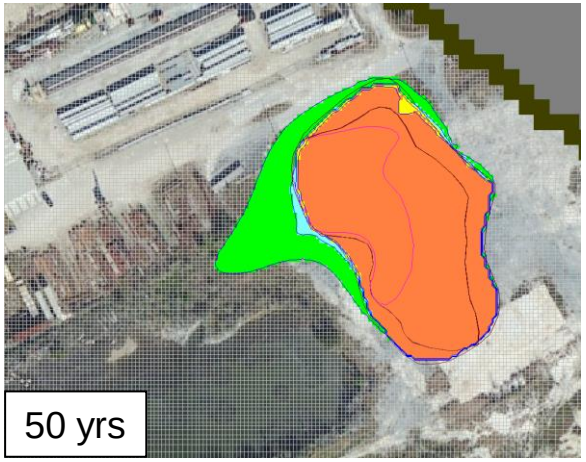

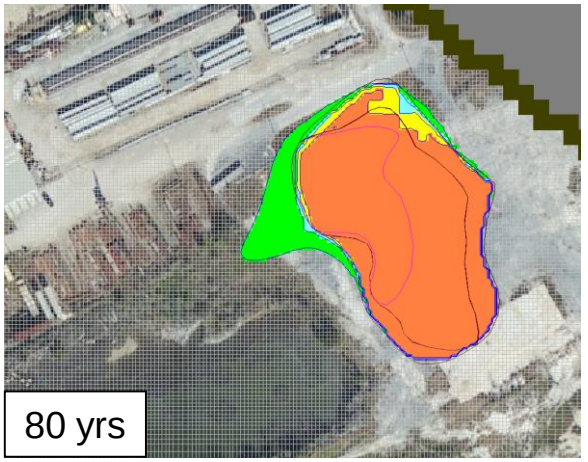

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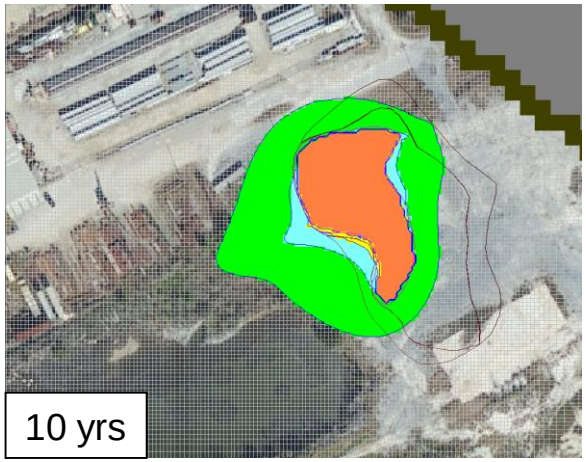

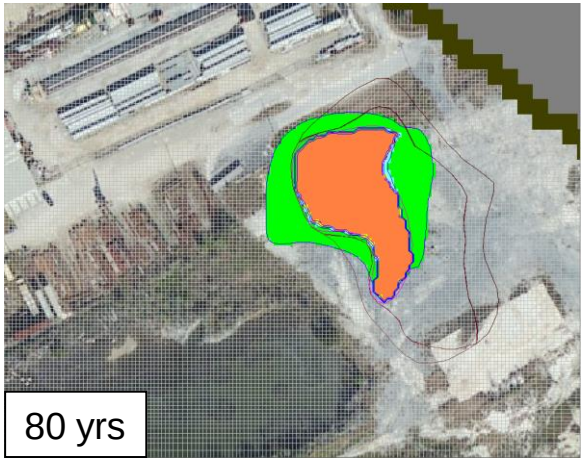

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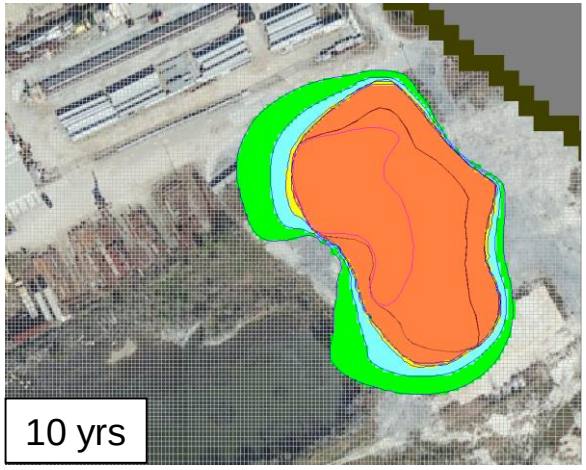

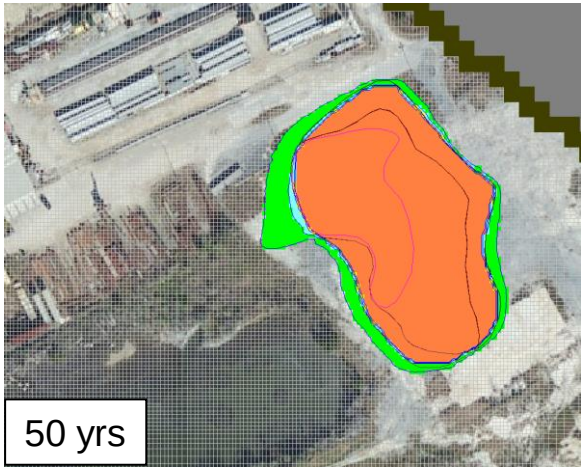

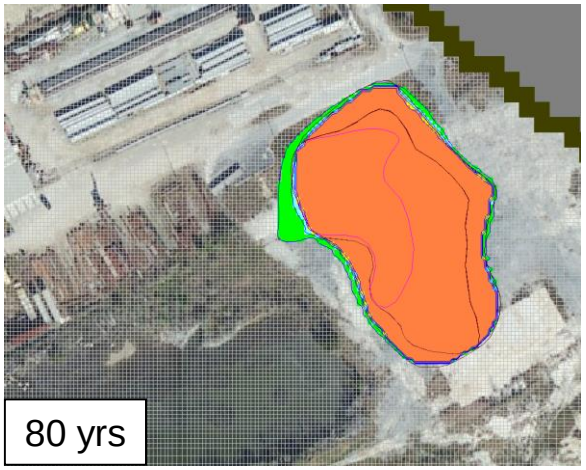

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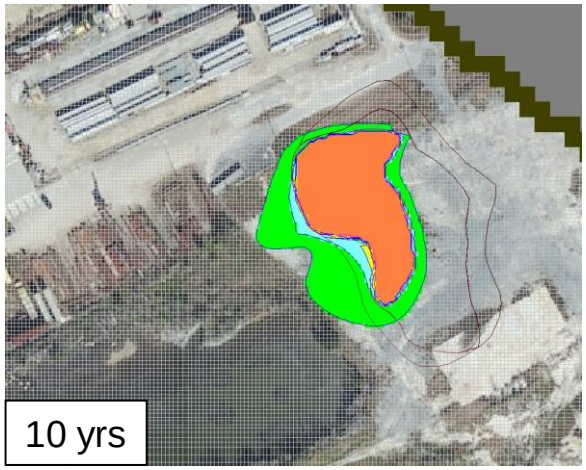

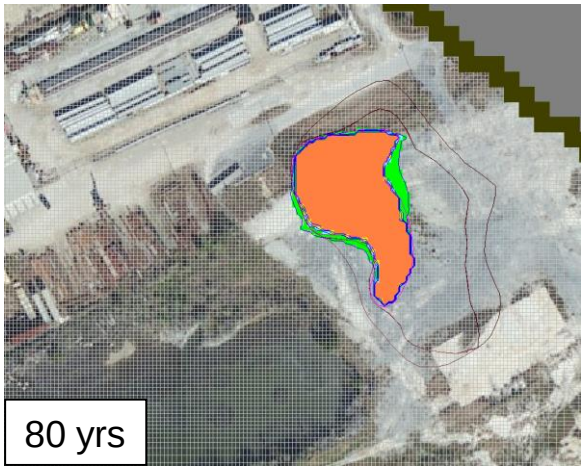

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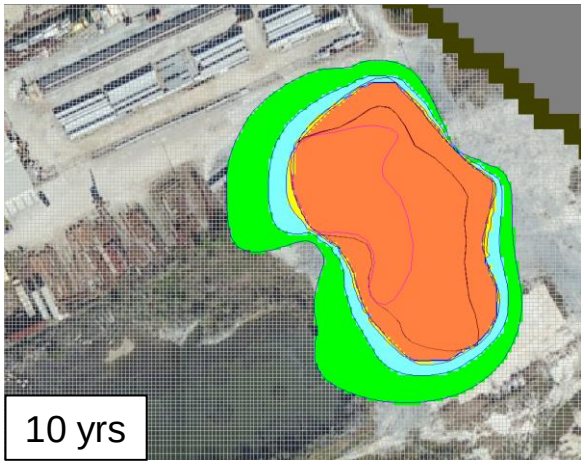

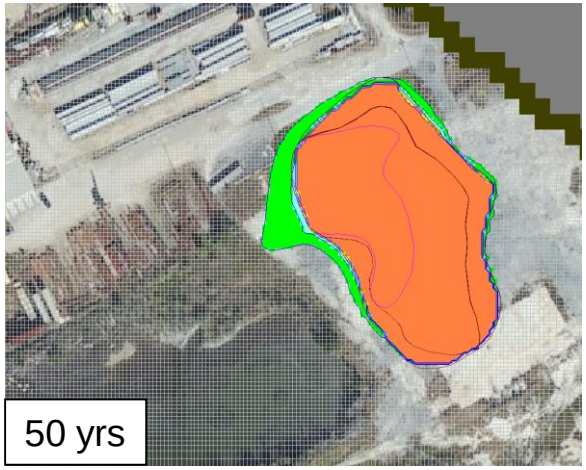

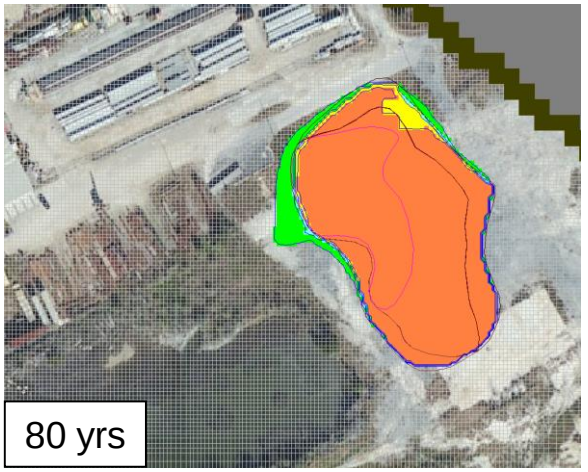

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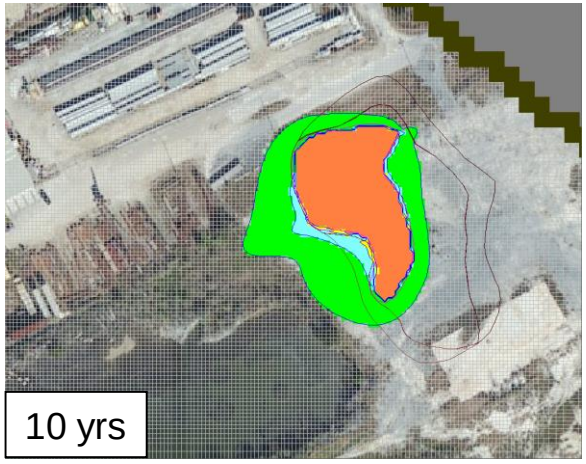

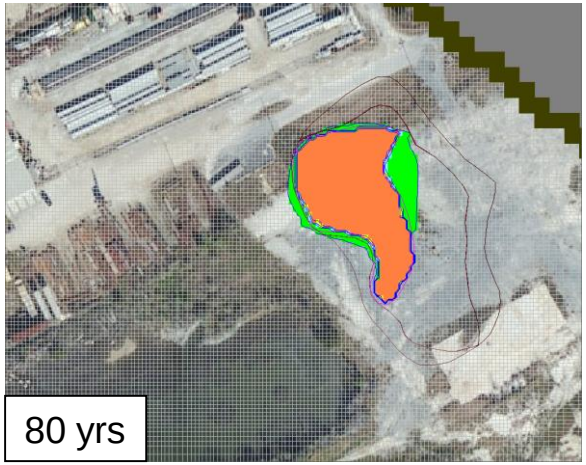

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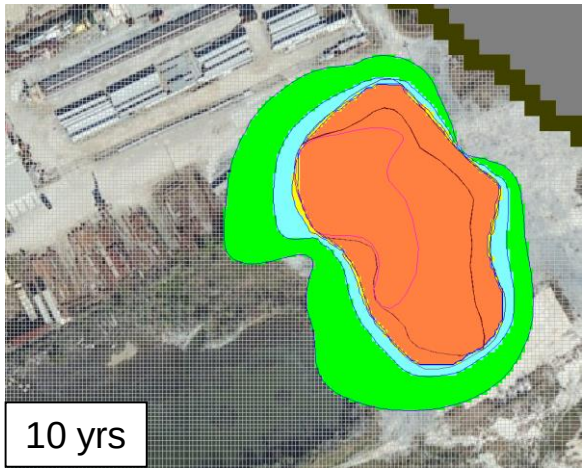

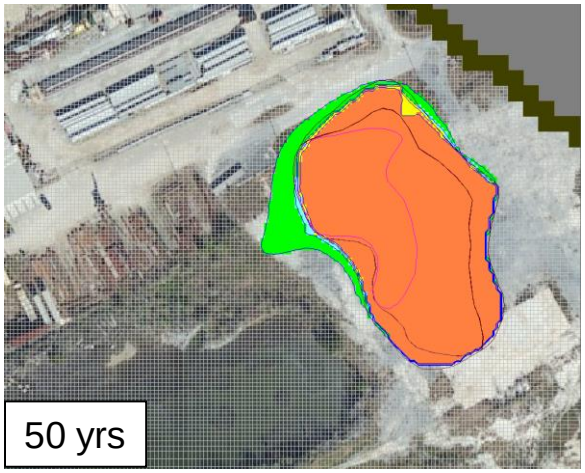

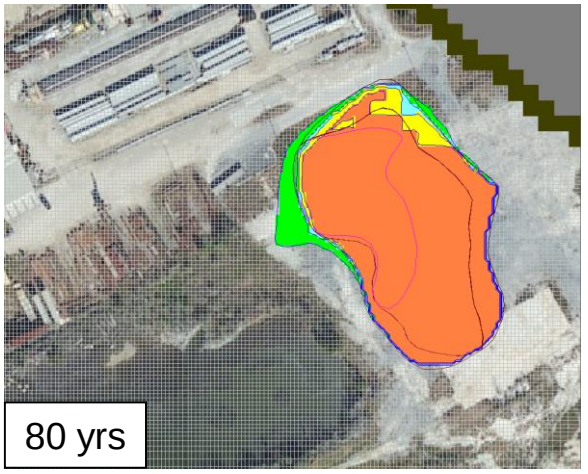

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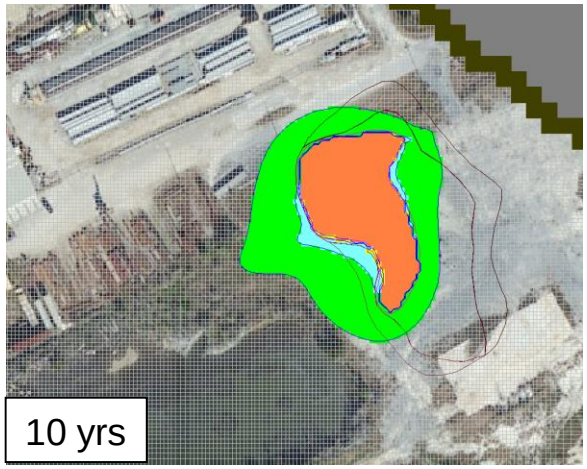

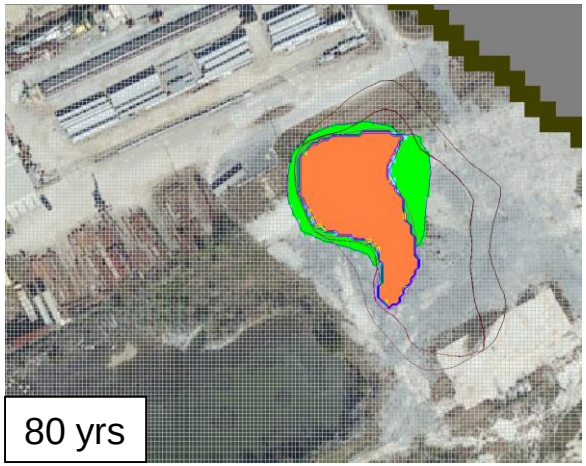

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